

NOTES

DATE	23 May 2013
PROJECT	Recovery/ARRA: Phase IV Renovation Richard Bolling Federal Building Contract # GS06P08GZC0011/ Project # IMO10450
SUBJECT	Wood Ceiling Panel and All Glass Door Entries Executive Summary
BY	Louis Zarr 916-426-2508
PEOPLE INVOLVED	Don Distler: GSA Tom Thomas: GSA Mike Heule: Helix Architecture + Design

Wood Ceiling Panels:

On Thursday, 16 May, a 2' x 2' +/- cherry wood ceiling panel fell to the terrazzo floor below in the 5th floor elevator lobby. The 5th floor is occupied by USACE and substantial completion for the core and west side of the 5th floor was 29 July 2009. No people were harmed. Both J.E. Dunn and PBS Kansas City North Field Office (KCNFO) representatives immediately visited the site of the fallen panel to review. On Friday, 17 May, Dunn had 5 finish carpenters review every wood ceiling panel in the project for solidity and signs of fatigue or wear. In addition, KCNFO inspected the wood ceiling panels and submitted a list of 6 "discrepancies", which were shared with the contractor. The list included one panel with veneer splitting and the rest having some misalignment at edges (these do not represent a structural or attachment concern).

This wood ceiling panel design resides on every floor 2 through 18. The panels are applied in an architectural woodwork institute approved method: attaching linear rails to the substrate to receive Z-clips; attaching individual Z-clips in the corners of each individual wood ceiling panel; applying silicone adhesive to each individual Z-clip and final sliding of Z-clips into the rail for a secure attachment. Panels are removable and when the contractor has been asked to remove a panel; before they are re-installed, the existing silicone is removed and replaced with new. The contractor has reviewed each of the 6 items listed.

There is currently no evidence or proof that this will be an on-going concern. The project team has yet to determine an exact cause as to why this occurred, but will remain steadfast in listening to options and addressing any new information salient to this situation. The fallen panel showed no obvious signs of abuse or fatigue; no nicks or gouges; no absence or indications of newly installed silicone at the Z-clips.

Possible reasons for this occurrence:

- A. The panel loosened from construction activities above. There are four floors that were completed, while construction activity progressed on the floor directly above. It appears that this is very unlikely in that the 5th floor was completed nearly 4 years prior to this panel falling. Of course, any ceiling panel could have been hit and loosened over the years only to become so weak that it fails, but there is no evidence to support this.
- B. When the contractor buys silicone, it is in cases of 24 tubes each. It is possible that a tube of silicone that was used for the 5th floor could not be up to expected standards and did not provide the adhesion qualities normally expected. This is unlikely, but not impossible.
- C. Every tenant in the building uses its own vendors for a myriad of reasons and these occasions are not shared with the renovation team. Uses include, but not limited to telephone and data cabling, security installations, cable TV, door hardware work and additional electrical work. These work scopes could all involve ceiling access. It is possible that a tenant vendor loosened this ceiling tile or removed and re-installed without use of new silicone to perform their own work scope and it inadvertently lead to the failure of this specific wood ceiling member.

The project team will continue to monitor, review and determine if additional attention to attachment methods is warranted.

Gastinger Walker Harden
+ **BeeTriplett Buck**

Architecture | Interior Design | Construction Management

817 Wyandotte | Kansas City, MO 64105 | 816.421.8200



NOTES

All Glass Door Entries

Over the course of four construction phases involving the modernization of the Richard Bolling Federal Building, 172 all glass door assemblies have been installed. All glass, frameless entries are the building standard for tenant entries on all the floors. In addition, some individual tenants have elected to add frameless glass entries within their spaces. All Glass Door entrances are not new or a novelty construction assembly. They have been in fabrication since 1937 and are very common in today's building construction industry. Insulite, the Phase IV glass door fabricator fabricates and ships approximately 24 glass doors per week, and has seen roughly a dozen failures/placements in the last 25 years. All of those breaks were due to the edge of the tempered glass being hit by another object..

History

Of the 172 installed all glass doors, four are known to have failed within the last 6 to 7 years. The most recent failure was last month which injured a Social Security Association Employee. The project team believes all but the most recent have had carts or buffers involved in the vicinity of the breakage. Absolute, specific detail regarding each occurrence remains vague.

Floor Lobby	Event	Year
15 floor*	Goodwill Employee and Floor Buffer	2006 or 2007
15 floor*	SSA Employee and Cart	2011 September
5 floor	Goodwill or USACE Employee and Cart	2012 October
14 floor	SSA Employee	2013 April

* Believed to be the same door in each incident.

Assessment of Installed Doors

The most recent breakage last month apparently did not involve an immediate edge impact, as the first three breakages did. Insulite (Phase IV glass fabricator) visually inspect each glass door and hardware that has been installed throughout the entire renovation. Insulite prepared a spreadsheet to identify the doors and any visible defects or potential hardware problems. Their comprehensive glass door review identified the following categories requiring potential attention:

1. Loose pulls: some are an ongoing maintenance issue, some are due to tampering with hardware.
2. Loose rail cladding: caused by striking rail, most likely with floor buffers.
3. Loose door bottom pivot: caused by continued use and represents an ongoing maintenance item.
4. Closer Pops: The closer is either loose or the patch fitting is cracked; caused by extending door past hold open position.
5. Leaking closers: Caused by failing seals on the closer requiring replacement. This is fairly common.
6. Chipped glass doors: These have chips on the edge of doors, the most vulnerable to being bumped.
7. Closer pops and loose or missing pulls: These doors received immediate attention.

While better qualified maintenance needs to happen with the doors, the Insulite representative did not feel loose hardware and the items noted above would be cause for a door failure in their current condition. Doors requiring immediate attention have been repaired. JEDunn is preparing a proposal for the maintenance required with the entire scope of issues identified for GSA's use.

Fabrication Quality Assurance

Representatives from the design and construction team visited Insulite's factory in Olathe, Kansas and reviewed the fabrication and tempering process. Besides sending glass to SGCC labs for testing, they also do daily testing in house to insure that they producing the finest quality glass possible. All factory tempered glass goes through three quality test procedures:. The first test is the LiteSentry (www.litesentry.com) at the end of the tempering line. The second test is a breakage test in which they pull a random lite of production glass off the end of the tempering oven and break it while it is lying flat to observe the break pattern. The third test they do is with a GASP surface stress polarimeter (www.strainoptics.com) which reads the surface compression of the glass after it has been tempered.

Etched Glass

In addition to common locations in the elevator lobbies and the potential for cart damage, the doors where breakage has occurred have also been surface etched with a specialized process developed by Skyline glass in Chicago. Due to the slight etching process developed by Skyline, it is common industry standard understanding that the tempered glass in no way is undermined by their surface etching process. Regardless, the design team asked specific questions to confirm the etching process does not compromise the tempered glass integrity, including Does the eco-etch process compromise the structural integrity of the glass; Has the Eco-etch been used on similar all-glass doors elsewhere; Have you seen this problem of all-glass doors shattering and what does Skyline do to keep the glass stable when using the Eco-etch? All responses supported the understanding that etching does not diminish the inherent characteristics of tempered glass.

NOTES

Destructive Testing

Insulite prepared a number of 24" x 36" x ½" tempered glass samples to demonstrate the relative strength of the glass when subjected to various external stresses. Knowing that the edge condition is the weakest point of any tempered glass unit, we also had them fabricate samples with a stainless steel edge channel to determine its improved resistance to panel edge breakage. The results of the breakage demonstrations are available on video at this link <https://www.box.com/s/4e4mlb0ayne4gy3i1q9x>. Testing samples include dropping a ½" thick tempered glass on its corner repeatedly from several inches, struck on the edge 16 times with a steel pipe and struck on the edge with a steel crowbar twice; struck with a steel punch tool and similar tests with a stainless steel edge on the glass;

Recommendations

Glass doors have been common in many applications for years and the project team has found no history of spontaneous breakage as these appear to be rare occurrences. When they do occur, it is commonly attributed to edge strikes or past edge strikes that may have weakened the tempered panel to the point that a lesser event may cause it to finally fail at some point in the future.

Based on our current understanding of the breakage occurrences at the RBBF, the project team believe breakage is likely caused by significant edge impacts at the time of the event or have been fractured and weakened such that future stresses have resulted in the door failure. Outlined below are recommendations for immediate implementation to try and minimize the potential for future breakages:

- Immediately repair all glass doors with hardware maintenance issues as identified in the glass survey.
- Due to the history of edge impacts on the glass doors, install a metal stainless steel "C" channel to the glass edge on the pivot and latch side of all glass doors to absorb strikes to the glass edges from foreign objects. This stainless steel edge will also serve as a measure for doors that take edge abuse by the marks that will be left in the stainless steel trim.
- It's unknown if opening the doors beyond the 105 degree hold open angle can cause enough stress to break the glass but consideration should be given to adding floor and/or ceiling stops at doors in the elevator lobbies area where breakages have occurred) so they cannot be pushed beyond the doors hold open threshold.
- Have Insulite train The Operations & Maintenance staff and contractors/vendors on being able to identify damage and any necessary maintenance on all glass doors. Actual maintenance should only be performed by qualified glazing professional such as Insulite.
- Implement an inspection program for all glass doors by GSA staff/contractors, and on a yearly basis by qualified personnel such as Insulite.
- A program should be implemented for building occupants to help explain specific characteristics of frameless glass doors in assisting them to better understand how to operate the glass doors and necessary care for other building finishes and systems.
- If another break occurs, document in photographs the glass debris prior to any clean-up. This may help determine where the break occurred and the possible cause.
- It is common industry standard understanding that door assemblies with "rails" perform the same as those with "patch" fittings. To demonstrate the strength of the current rail/patch fitting combination, a full scale mockup test of the glass assembly's ability to resist torque in the surface of the glass with current hardware and hold opens can be performed. While not scientific, this test can provide antidotal evidence to help better understand the stressed threshold it takes to fail a glass door.

Note that these findings and recommendations are based on the project team's observations, discussions with others and research to date. A more detailed analysis by a consultant knowledgeable in materials research and engineering of glass door assemblies may be warranted to better understand the failures that have occur without the obvious causes such as carts and edge impacts.

The preceding is our interpretation of the occurrences and conversations. Please contact us if any details appear to be in error or if you have questions or comments.

J:/GSA/written/meeting notes/Phase IV-glass entry systems and wood ceiling panels memo B _23may12.doc